

**ORTHOTYLUS ROBINIAE: A GLEDITSIA RATHER THAN ROBINIA
SPECIALIST THAT RESEMBLES THE HONEYLOCUST PLANT BUG,
DIAPHNOCORIS CHLORIONIS (HETEROPTERA: MIRIDAE)**

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Abstract.—A little-known plant bug, *Orthotylus robiniae* Johnston, is reported as the eighth mirid species that specializes on honeylocust (*Gleditsia triacanthos*). It has gone unnoticed on native and ornamental honeylocust because nymphs and adults are remarkably similar to those of the more abundant *Diaphnocoris chlorionis* (Say), the honeylocust plant bug, and because it has a similar seasonal history. Seasonality of a Pennsylvania population of *O. robiniae* is reported, and 18 new state records are given. Diagnoses are provided to allow the adult and nymphs of *O. robiniae* to be separated from the pestiferous *D. chlorionis*.

Key Words: Heteroptera, Miridae: *Orthotylus robiniae*, hosts, misnomer, *Robinia*, *Gleditsia*, biology, distribution

Honeylocust, *Gleditsia triacanthos* L. (Fabaceae), is a leguminous tree native to much of eastern North America. Fruitless and thornless cultivars have been widely planted as ornamentals. A diverse plant bug or mirid fauna is associated with this plant, both in its natural habitat (usually rich woods, bottomlands, and flood plains) and in the urban and suburban landscape. In addition to several species that use honeylocust as an occasional or adventitious host, seven species apparently are restricted to this tree. These specialists include the mainly flower-feeding mirines *Lygocoris tinctus* (Knight) and *Taedia gleditsiae* (Knight) and phyelines *Plagiognathus delicatus* (Uhler) and *P. gleditsiae* Knight; the foliage-feeding orthotyline *Diaphnocoris chlorionis* (Say) and *Lopidea incurva* Knight; and a mainly predatory phyline *Pilophorus walshii* Uhler (Wheeler and Henry 1976).

Orthotylus robiniae Johnston. This green orthotyline is easily confused with the honeylocust plant bug, *D. chlorionis*, an important pest of ornamental honeylocust. Herein we give new state records of *O. robiniae*; summarize our biological observations, comparing and contrasting what is known of its seasonality and habits with those of *D. chlorionis*; and provide diagnoses that allow the adult and nymphs to be separated from those of the honeylocust plant bug.

Orthotylus robiniae Johnston

This mirid was described from Natchez, Mississippi, based on 18 specimens collected 15 May 1931, on "locust (*Robinia pseudo-acacia*), which is no doubt the host plant" (Johnston 1935). Knight (1941) added Illinois to the known distribution and, apparently based on Johnston's statement, listed black locust, *R. pseudoacacia* L., as

An overlooked honeylocust specialist is

the host. Froeschner (1949) reported it from Missouri; Blinn and Yonke (1986) gave additional Missouri records, including specimens collected from black locust and from honeylocust.

We first encountered *O. robiniae* on honeylocust in eastern Texas in 1983. A collection assumed to represent the common *D. chlorionis* proved to be a mixture of that species and *O. robiniae*. The latter, however, had not been found during a survey of the Miridae associated with honeylocust (Wheeler and Henry 1976). But the outbreak levels of *D. chlorionis* on trees used for our study of seasonal history in Pennsylvania would have masked small numbers of *O. robiniae*. Because we had not suspected the presence of a putative black locust feeder on honeylocust, we did not scrutinize each green orthotyline in weekly samples that contained several hundred or even more than 2000 honeylocust plant bugs (Wheeler and Henry 1976).

Distribution.—A resurvey of honeylocust in the eastern United States, which was begun after discovery of *O. robiniae* on this plant in 1983, resulted in the following new state records (Fig. 1). All records are from our fieldwork except Iowa, which is from material in the National Museum of Natural History, Washington, D.C. (USNM), and New York, which is from a collection by K. Valley. Voucher specimens have been deposited in the collections of the USNM and Pennsylvania Department of Agriculture, Harrisburg (PDA).

USA: ALABAMA. *Lee Co.*: Auburn University, Auburn, 7 May 1986. CONNECTICUT. *Hartford Co.*: Canton, 16 June 1991. DELAWARE. *New Castle Co.*: University of Delaware, Newark, 23 June 1984. INDIANA. *Cass Co.*: Logansport, 5 July 1986. IOWA. *Boone Co.*: Madrid, 27 June 1964, R. Baldwin; *Story Co.*: Ames, 21 June 1964, H. H. Knight and 26 June 1964, W. S. Craig. KENTUCKY. *Anderson Co.*: Nr. Johnsonville, 6 June 1985; *Simpson Co.*: Nr. Prov-

idence, 4 June 1985. MARYLAND. *Carroll Co.*: Eldersburg and Western Maryland College, Westminster, 25 May 1991. MASSACHUSETTS. *Berkshire Co.*: North Adams State College, North Adams, 15 June 1991. NEW HAMPSHIRE. *Strafford Co.*: University of New Hampshire, Durham, 27 June 1989. NEW YORK. *Herkimer Co.*: West Winfield, 30 June 1984; *Onondaga Co.*: Skaneateles, 30 June 1984; *Ontario Co.*: Naples, 24 June 1984, K. Valley; *Seneca Co.*: Seneca Falls, 30 June 1984; *Tompkins Co.*: Cornell University, Ithaca, 24 July 1983. OHIO. *Athens Co.*: Ohio University, Athens, 19 May 1991. PENNSYLVANIA. Numerous localities in counties of Bradford, Butler, Centre, Clinton, Cumberland, Dauphin, Elk, Huntingdon, Indiana, Juniata, Lancaster, Lycoming, Mifflin, Montour, Northumberland, Snyder, Susquehanna, Union, Warren, Westmoreland, and York. SOUTH CAROLINA. *Pickens Co.*: Clemson University, Clemson, 4 May 1991. TENNESSEE. *Dyer Co.*: N. of Dyersburg, 2 June 1985; *Hawkins Co.*: Nr. Surgoinsville, 26 May 1985. TEXAS. *Grimes Co.*: Nr. Anderson, 30 April 1983. VERMONT. *Bennington Co.*: Bennington College, Bennington, 15 June 1991. VIRGINIA. *Clarke Co.*: Univ. Va. Blandy Exp. Farm, 2 mi. S. of Boyce, 39°05'N, 78°10'W, 4 June 1993. *Montgomery Co.*: VPI & SU campus, Blacksburg, 2 June 1989; *Rockingham Co.*: Harrisonburg, 25 May 1985. WEST VIRGINIA. *Marion Co.*: Fairmont State College, Fairmont, 6 June 1991.

Seasonal history and habits.—Information on seasonality is based mainly on collections and observations made at Emigsville (York Co.), Pennsylvania. On each sample date in 1985 and 1986 (late April to early July), green orthotyline nymphs were collected from a large native honeylocust tree by tapping branches over a small wooden tray (25 × 30 cm). They were preserved (number not standardized) in 70% ethanol and sorted to species (*D. chlorionis* or *O.*

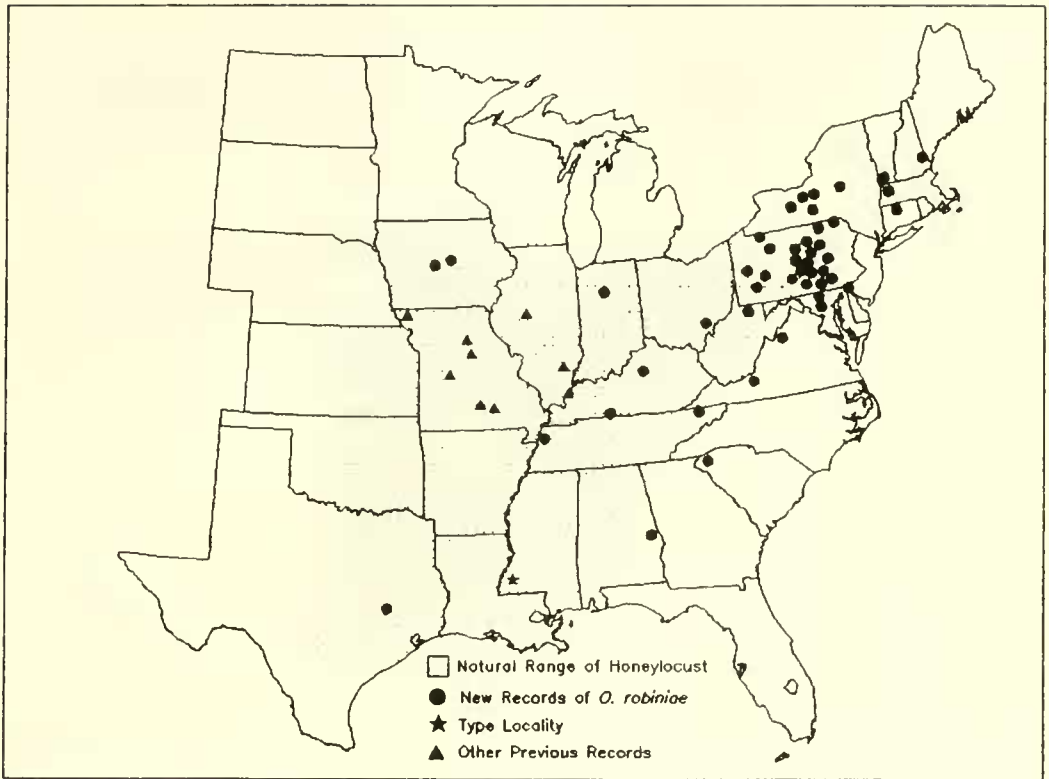


Fig. 1. Distribution of *Orthotylus robiniae* in relation to that of its host plant, *Gleditsia triacanthos*; range of honeylocust is based on Little (1971).

robiniae) and instar in the laboratory. Once adults appeared, a sample (unstandardized number) was collected for identification.

In addition, two native honeylocusts were sampled twice each week in 1991 (10–23 May) at the same site. A sample of green orthotyline nymphs was collected (first 50 encountered during beating of foliage over a tray) and preserved in alcohol for laboratory analysis. Sampling continued until no nymphs of either species were found (28 May). Supplemental biological data were obtained from collections and observations made in Pennsylvania nurseries during 1983–1986.

In 1991, the presence of second instars on 10 May (Fig. 2) suggests that egg hatch of *O. robiniae* had begun by early May. Populations of *D. chlorionis* on 10 May con-

sisted mainly of third instars; its eggs are known to hatch from early to late April in south-central Pennsylvania (Wheeler and Henry 1976, Wheeler and Loan 1984). Third- and fourth-instar *O. robiniae* were taken on 16 May when four teneral adults of *D. chlorionis* were collected and fifth instars predominated in the 50-nymph sample. By 20 May, fourth and fifth instars of *O. robiniae* were present with fifth instars (23 of 31 parasitized) and numerous adults of *D. chlorionis*. Three days later nearly all individuals of *O. robiniae* were fifth instars (37 of 38), and all remaining fifth instars of *D. chlorionis* (12 in sample) were parasitized. The first *O. robiniae* adults were collected on 28 May, when no nymphs of either mirid could be found.

Seasonality in 1991 was similar to that

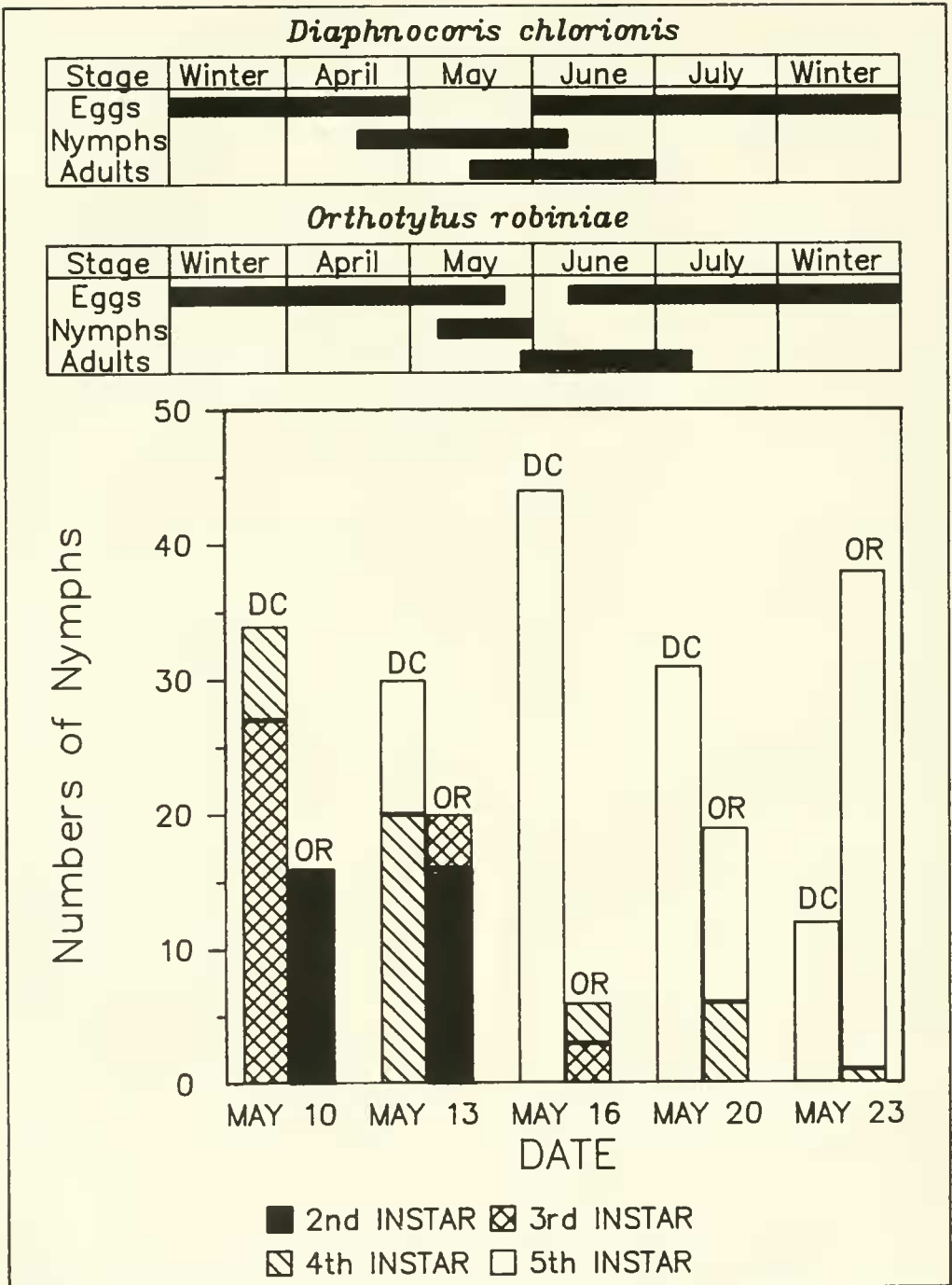


Fig. 2. Seasonal history of *D. chlorionis* (DC) and *Orthotylus robiniae* (OR) in south-central Pennsylvania in 1991; a generalized seasonality of both species is shown above.

observed in 1985 and 1986. Adults of *O. robiniae* were first seen on 28 May in 1985; only late-stage nymphs (mostly fifth instars) had been found three days earlier. In 1986, *O. robiniae* adults were first collected in the 2 June sample.

Males of both species are present for a short period. Although males of *D. chlorionis* outnumbered females (29:25) in a sample taken 31 May 1985 at Emigsville, males were absent on 6 June and in later collections. A few males of *O. robiniae* were present on 20 June, but none could be collected a week later. No adults of either species were seen on 5 July 1985. Our latest record of *O. robiniae* at Emigsville is 9 July 1984.

In certain localities and on some trees *O. robiniae* is absent, or its numbers are much smaller than those of *D. chlorionis*. Rarely are densities of *O. robiniae* equal to those of *D. chlorionis*, although by mid-June, when numbers of the honeylocust plant bug are declining, adults of *O. robiniae* may outnumber *D. chlorionis* adults.

Feeding habits of *O. robiniae* were not determined. Nymphs were beaten from nonflowering branches of honeylocust with those of *D. chlorionis*, and adults have been observed on leaflets. This species may contribute to the foliar injury caused by the honeylocust plant bug (Wheeler and Henry 1976, Herms et al. 1987), but its feeding likely does not produce the chlorosis, distortion, and defoliation that are characteristic of early season feeding by *D. chlorionis*. Sucking insects, including mirids, do not always induce feeding symptoms on their host plants (e.g. Puchkov 1956).

Diagnostic features.—*O. robiniae* keys to the genus *Orthotylus* in Knight (1941) based on the convergent parempodia, simple pubescence, and lack of a carina on the vertex of a relatively narrow head. In Knight's key, *O. robiniae* is recognized by the overall green coloration, small size (less than 4.00 mm), simple pale dorsal setae, relatively long ro-

strum extending to the apex of the mesosternum or bases of the mesocoxae, and the shorter second antennal segment that is less than three times the width of the vertex.

Superficially *O. robiniae* resembles *D. chlorionis* in size, shape, and overall green coloration. However, it is readily separated by the longer rostrum extending past the mesosternum to the mesocoxae (extending only to the middle of the mesosternum in *D. chlorionis*), pale dorsal setae (pale mixed with dark-brown or fuscous setae in *D. chlorionis*), the shorter first antennal segment in males that is shorter than the width of the vertex (longer than vertex in *D. chlorionis*), the shorter second antennal segment in males that is subequal to the basal width of the pronotum (much longer than width of pronotum in *D. chlorionis*), and by the male genitalia. The aperture of the male genital capsule is large and open; the right paramere has three long, apically acute processes forming a 3-pronged, comblike structure (figured by Knight 1941); and the left paramere is stout and C-shaped. In *D. chlorionis* the aperture of the male genital capsule is very small, open enough only to accommodate the small, simple parameres (figured by Knight 1941 and Kelton 1965), characteristics that prompted Kelton (1965) to transfer this species from *Orthotylus* to his genus *Diaphnocris*.

Nymphs of these two species also are quite similar in size and color and are easily confused. We have found that antennal segment III in *O. robiniae* is always longer than segment II, whereas in *D. chlorionis* antennal segment III is always shorter than segment II. This character will separate the two species regardless of instar. The length of the rostrum also will aid in separating them, although well-preserved individuals are necessary to ensure accurate interpretation. In *O. robiniae* the rostrum nearly attains the metacoxae, whereas in *D. chlorionis*, it extends just past the procoxae.

DISCUSSION

Orthotylus robiniae and the honeylocust plant bug, *Diaphnocoris chlorionis*, are univoltine, similar-appearing orthotyline mirids that develop on honeylocust. Both species now occur well outside the original range of this tree (see Fig. 1). Range expansion of the plant bugs probably has resulted more from movement of egg-infested honeylocust nursery stock than from natural dispersal of adults.

Seasonal history of the two mirids also is similar. Egg hatch of *D. chlorionis* occurs in early to late April in south-central Pennsylvania, whereas *O. robiniae* eggs hatch about two weeks later (early May in 1991). Both are found on honeylocust leaflets, although it has not been shown that *O. robiniae* causes symptoms similar to those of *D. chlorionis*. Because *O. robiniae* populations have not been observed to reach the outbreak numbers characteristic of the honeylocust plant bug on ornamental cultivars, this "lookalike" mirid may not be economically important. At most, it would prolong feeding pressure from green Orthotylineae on honeylocust and perhaps slightly intensify the injury inflicted by *D. chlorionis*.

We can be more definite about the host range of *O. robiniae* than about its precise manner of feeding and economic importance. The specific epithet *robiniae* is a misnomer. *Orthotylus robiniae* is a *Gleditsia* mirid, the eighth species of the family known to specialize on honeylocust. It does not occur on *Robinia pseudoacacia* (black locust) as its name implies, except perhaps as occasional or accidental adults that disperse from honeylocust.

We suggest that Johnston (1935) actually collected the type series on *Gleditsia triacanthos* rather than on *Robinia pseudoacacia*. The host plant may have been misidentified in the field. Or the tree could have been recorded as "locust" in field notes and the kind of locust incorrectly stated when the species was described several years later.

Honeylocust often is confused with black locust (Collingwood and Brush 1947), and in some parts of the United States honeylocust has been mistakenly called black locust (Li 1963). It seems unlikely that such a large number of adults (18) would have dispersed to black locust. We have collected nymphs only on honeylocust and have not found adults on black locust.

Discovery of a honeylocust plant bug lookalike raises several questions concerning previous work on *D. chlorionis*. Was the initial biological study of this honeylocust pest (Wheeler and Henry 1976) based on a mixed-species population? Was the host of *Peristenus henryi* Loan, a braconid parasitoid of the honeylocust plant bug (Wheeler and Loan 1984), accurately identified, or was it *O. robiniae*, or both species?

Our seasonal history work on *D. chlorionis* (Wheeler and Henry 1976) was done mainly in a Harrisburg, Pennsylvania, cemetery. No *O. robiniae* were found in alcohol-preserved adults (several hundred) used in that study, although most adults taken in weekly sampling were not preserved. After we realized *O. robiniae* is a honeylocust feeder that could easily have been overlooked in our earlier study, we resampled and detected it at the cemetery in 1983 and 1984. One adult was collected in 1983, and a sample of adults taken on 19 June 1984 contained 90 *D. chlorionis* and 5 *O. robiniae*. It is possible that the large population of *D. chlorionis* recorded in weekly sampling during 1975 and 1976 (Wheeler and Henry 1976) consisted of a small number of unrecognized *O. robiniae*. But if the ratio of *O. robiniae* to *D. chlorionis* in Harrisburg had been as high as that later encountered at Emigsville, we are confident that the presence of a second green orthotyline would have been noticed. At Harrisburg, small numbers of *O. robiniae* in a large population of *D. chlorionis* (usually 500 to >2000 individuals per sample) would not have significantly altered the seasonality reported for the honeylocust plant bug. Later studies

of this pest (e.g. Herms et al. 1987), assuming low densities of *O. robiniae*, would similarly be little affected.

The description of *Peristenus henryi* as a nymphal parasitoid of *D. chlorionis* and a rearing record of *Leiophron maculipennis* (Ashmead) from the same mirid (Wheeler and Loan 1984) could well have been based on a misidentification of the host. The holotype of *P. henryi* and six of nine paratypes were reared from green orthotylinines collected on the same honeylocusts at Emigsville where *D. chlorionis* and *O. robiniae* are now known to coexist. However, adults of this parasitoid were collected from honeylocust during 21–28 April 1976 when second- and third-instar *D. chlorionis* were present (Wheeler and Loan 1984); parasitoid females may have emerged slightly earlier because *Peristenus* spp. usually parasitize first or second instar mirids (Loan 1974). In any case, the time of adult emergence is synchronized with the appearance of early instar *D. chlorionis* rather than *O. robiniae*.

In addition, parasitized nymphs of the honeylocust plant bug were common during sampling at Emigsville in 1991, whereas no parasitism was observed in *O. robiniae*. It is therefore likely that the two euphorine braconids are indeed natural enemies of the injurious *D. chlorionis* rather than the less common *O. robiniae*.

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